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(54) Image exposure control apparatus in multicolor printing press

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operation. The adjustment section (110a) adjusts an exposure position of a pixel of an image to be exposed for each color, on the basis of the correction amount read out from said memory means (110j,110k), in exposing the image on a printing plate.

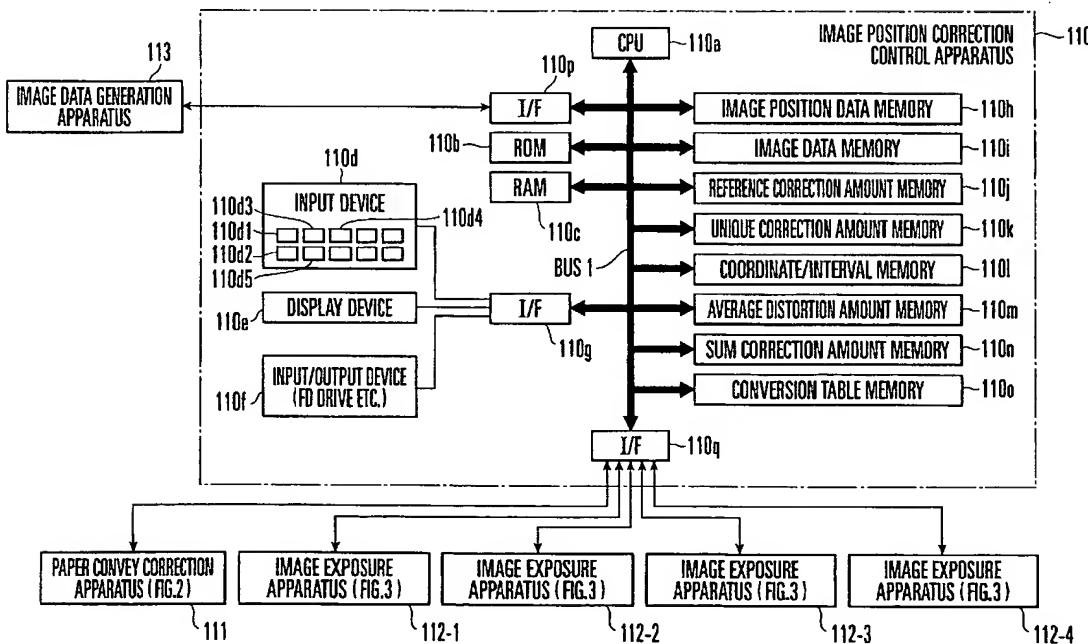


FIG. 1



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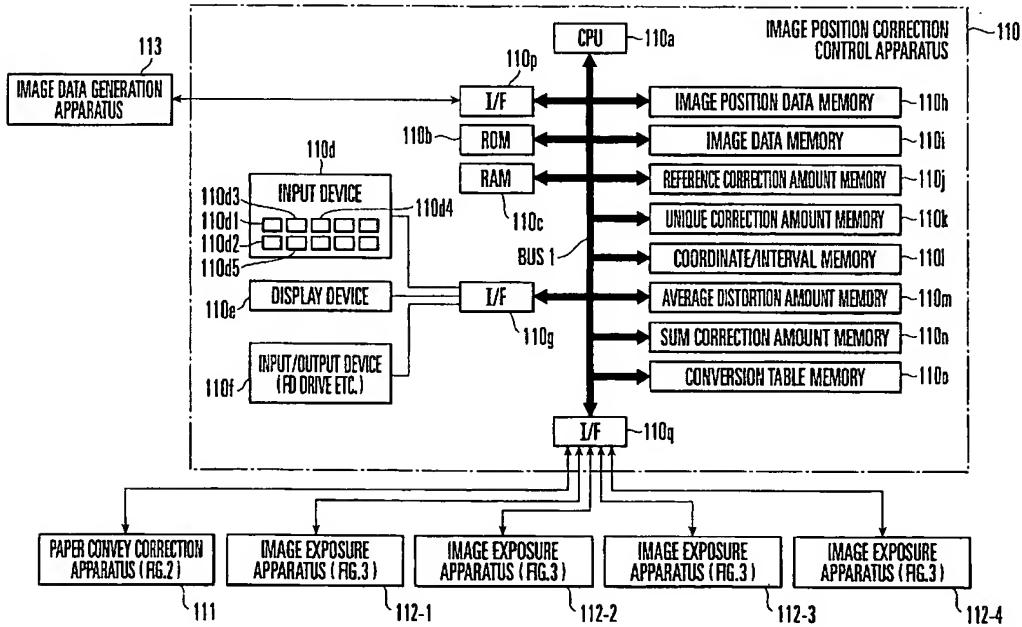


FIG. 1

DescriptionBackground of the Invention

[0001] The present invention relates to a control apparatus for an image exposure apparatus which exposes an image on a printing plate, an image exposure apparatus, and a control apparatus which controls a multicolor printing press.

[Plate Making on Press]

[0002] In recent years, in order to improve the efficiency of plate making operation or to improve the registration accuracy, a plate making apparatus is attached to a printing press itself whereby plate making operation is directly performed on the printing press by the plate making apparatus. That is, instead of using a plate making apparatus separated from a printing press, a printing plate (raw plate) mounted on a plate cylinder is irradiated with a laser beam from the head of a plate making apparatus attached to a printing unit, thereby exposing an image. This operation is called plate making on press.

[0003] More specifically, the rotation speed of the printing press is increased to a designated value. When the rotational speed has stabilized, laser irradiation (exposure) from the head to the printing plate is started. After that, the head is moved in the axial direction of the plate cylinder while continuing exposure, thereby exposing an image on the entire plate mounted on the plate cylinder. The exposure time is determined by the plate size and the designated rotational speed at the time of exposure. Techniques for exposing an image on a printing plate by laser irradiation are disclosed in U.S. Patent No. 5,379,698 (reference 1) and the like, and a detailed description thereof will be omitted.

[0004] Fig. 4 shows the attached state of plate making apparatuses to a four-color rotary printing press. Referring to Fig. 4, plate making apparatuses 102-1 to 102-4 are attached to printing units 101-1 to 101-4 of the respective colors. The plate making apparatuses 102-1 to 102-4 are normally at positions indicated by the alternate long and two dashed lines in Fig. 4. When exposure operation is to be performed, they are moved close to plate cylinders 103-1 to 103-4 in the printing units 101-1 to 101-4. Reference numerals 104-1 to 104-4 denote blanket cylinders on which blankets are mounted. Impression cylinders (not shown) are arranged under the blanket cylinders 104-1 to 104-4.

[0005] Fig. 5 shows main part of a plate making apparatus 102. The plate making apparatus 102 has an exposure unit 102b having a head 102a. The exposure unit 102b is fixed on a table 102c. The table 102c moves in the axial direction (indicated by a double-headed arrow A-B) of a plate cylinder 103 while being guided along rails 102f1 and 102f2 on a base 102f by a ball screw 102e rotated by a motor 102d. A printing plate (raw

plate) 105 is mounted on the surface of the plate cylinder 103.

[0006] In plate making on press, the exposure range of an image onto the printing plate 105 is set before the start of actual image exposure by causing an operator to input the X-coordinate distance (X1,0) from the origin (0,0) at the left edge on the leading edge side of the printing plate 105 to the left edge of the image range and the Y-coordinate distance (0,Y1) to the leading edge 10 of the image range, as shown in Fig. 6. That is, let W be the image size in the X-axis direction, and H be the image size in the Y-axis direction. The origin (0,0) is defined at the left edge on the leading edge side of the printing plate 105. The image range is defined by X-coordinates "X1" and "X1 + W" and Y-coordinates "Y1" and "Y1 + H".

[0007] Assume that the number of pixels of the image is n in the X-axis direction and m in the Y-axis direction, as shown in Fig. 7. A distance ΔX between the pixels in the X-axis direction is given by $\Delta X = W/n$, and a distance ΔY between the pixels in the Y-axis direction is given by $\Delta Y = H/m$. The plate making apparatus 102 defines ΔX and ΔY as the exposure intervals in the X- and Y-axis directions and exposes image data that is input in advance within that image range.

[0008] More specifically, the head 102a of the plate making apparatus 102 is moved from the left to the right while rotating the plate cylinder 103 at a predetermined rotational speed. The head 102a is stopped at the position X1, and the pixels of one line in the Y direction are exposed at the interval ΔY . That is, pixels within the range from (X1,Y1) to (X1,Y1+H) are exposed. Next, the head 102a is moved to the right by ΔX . At the next position, the pixels of the next line in the Y direction are exposed at the interval ΔY . This operation is repeated until the X-coordinate "X1 + W".

[0009] The image data (image "1"/non-image "0") of each pixel is not stored in correspondence with the data of its exposure position. Only data of image "1"/non-image "0" are sequentially stored. In actual exposure, the image data are sequentially read out, and the pixels are sequentially exposed from the position (X1,Y1) at the interval ΔY in the Y direction and at the interval ΔX in the X direction. This is because the number of image data to be processed is enormous. If the image data are collated with position data and exposed one by one, a very long time and large storage capacity are impractically required.

[0010] In printing by a rotary printing press, a high pressure must be applied to printing paper between the blanket cylinder and the impression cylinder. For this reason, the printing paper stretches toward the trailing edge side. Hence, the image printed by the preceding printing unit expands into a wide trapezoidal shape toward the trailing edge side, resulting in misregistration between colors. This tendency is especially conspicuous in offset printing because printing is executed with water supplied.

[0011] Fig. 8 shows an image state on printing paper after printing of the second color. A printing paper sheet 106 stretches due to printing by the second-color printing unit, and a first-color image 107 expands into a trapezoidal shape. For this reason, shifts are generated between the first-color image 107 and a second-color image 108. That is, shifts w_1 and w_2 in the horizontal direction (a direction perpendicular to the sheet convey direction) of the printing paper sheet 106, a shift h in the vertical direction (sheet convey direction), and shifts (distortion amounts) s_1 and s_2 due to distortions are generated. Similarly, the first- and second-color images further expand into trapezoidal shapes due to printing by the third-color printing unit. The first-, second-, and third-color images further expand into trapezoidal shapes due to printing by the fourth-color printing unit. In this way, shifts are generated between the color images, resulting in a defective printing product.

[0012] To solve this problem, the present applicant proposed in Japanese Patent Laid-Open No. 2000-309084 (U.S. Patent No. 6,283,467; reference 2) a sheet-like object convey apparatus which stretches the trailing edge side of a printing paper sheet in the horizontal direction (right-to-left direction) upon transferring the printing paper sheet to a printing section whereby the shape of the printing paper sheet is deformed in advance into a trapezoidal shape whose width increases toward the trailing edge side to eliminate or reduce stretching of the printing paper sheet during printing, thereby eliminating or reducing the shift of the image due to distortion by the stretch of the printing paper sheet during printing. The correction operation of the sheet-like object convey apparatus disclosed in reference 2 will be described with reference to Figs. 10 and 11.

[0013] Referring to Fig. 10, when a swing 1 pivots from a point b to a point a , i.e., the gripping position of a feeding cylinder 4 along with rotation of a feeding cylinder shaft 4a, the edge portion of a paper sheet 6 is gripped by a plurality of gripper units (not shown) each formed from a gripper and gripper pad. Simultaneously, the central portion of a support shaft (not shown) that supports the gripper units is pressed and deflected by α , as indicated by the alternate long and two dashed line in Fig. 11. When the support shaft deflects, the gripper units at the central portion retreat from those on both sides by α . In this state, when the feeding cylinder shaft 4a rotates to move the swing 1 from the point a to the point b , press against the support shaft is canceled. All the gripper units are aligned on one line, as indicated by the solid line in Fig. 11.

[0014] When the gripper units at the central portion move, the directions of gripper units are changed toward the left and right end sides of the paper sheet 6 from the central portion relatively to those in gripping the paper sheet. The paper sheet 6 is stretched to become wide toward the trailing edge side. With this operation, the paper sheet 6 is deformed in advance into a trapezoidal

shape whose width increases toward the trailing edge side before printing. Since stretching of the printing paper sheet during printing is eliminated or reduced, the shift of the image due to distortion by the stretch of the printing paper sheet during printing is eliminated or reduced. Hence, fan-out registration is corrected. Reference numeral 5 denotes a lower swing; 6a, a feedboard; and 7, an impression cylinder.

[0015] According to the sheet-like object convey apparatus described in reference 2, of the shifts of the image, the shifts s_1 and s_2 due to distortions are corrected, as shown in Fig. 9. However, since the shifts w_1 and w_2 in the horizontal direction and the shift h in the vertical direction cannot be corrected, defective printing products cannot be completely avoided.

Summary of the Invention

[0016] It is an object of the present invention to provide a control apparatus for an image exposure apparatus, which eliminates misregistration between colors due to stretch of a printing paper sheet and prevents any defective printing product.

[0017] In order to achieve the above object, according to the present invention, there is provided an image exposure control apparatus comprising memory means for storing a correction amount for each color in accordance with a stretch amount of a printing paper sheet in multi-color printing operation, and adjustment means for adjusting an exposure position of a pixel of an image to be exposed for each color, on the basis of the correction amount read out from the memory means, in exposing the image on a printing plate.

Brief Description of the Drawings

[0018]

Fig. 1 is a block diagram of a control apparatus for an image exposure apparatus according to an embodiment of the present invention;
 Fig. 2 is a block diagram of a paper convey apparatus shown in Fig. 1;
 Fig. 3 is a block diagram of the image exposure apparatus shown in Fig. 1;
 Fig. 4 is a side view showing the schematic arrangement of a four-color rotary printing press to which plate making apparatuses are attached;
 Fig. 5 is a perspective view showing main part of the plate making apparatus shown in Fig. 4;
 Fig. 6 is a view showing the image exposure range on a printing plate;
 Fig. 7 is a view for explaining a pixel interval ΔX in the X-axis direction and a pixel interval ΔY in the Y-axis direction of an image to be exposed onto the printing plate;
 Fig. 8 is a view showing a printing paper sheet after printing by the second-color printing unit and an im-

age printed on the printing paper sheet; Fig. 9 is a view for explaining image shift correction in a conventional correction apparatus; Fig. 10 is a side view showing the schematic arrangement of a conventional sheet-like object convey apparatus having a conventional correction function; and Fig. 11 is a view showing the positions of gripper units at the times of paper gripping and gripping change.

Description of the Preferred Embodiment

[0019] The present invention will be described below in detail with reference to the accompanying drawings.

[0020] First, the principle of the present invention will be described. Referring to Fig. 9, to align a second-color image 108 with a first-color image 107, the X-coordinate at which image exposure to the second-color printing plate starts is moved by $-w_1$ to set an X-axis direction pixel interval ΔX given by

$$\Delta X = (W + w_1 + w_2)/n$$

In addition, a Y-axis direction pixel interval ΔY is set to

$$\Delta Y = (H + h)/m$$

[0021] That is, w_1 , w_2 , and h are measured in advance. The start position of image exposure to the second-color printing plate is adjusted from (X_1, Y_1) to $(X_1 - w_1, Y_1)$. The pixel interval ΔX in the X-axis direction is adjusted from W/n to $(W + w_1 + w_2)/n$. The pixel interval ΔY in the Y-axis direction is adjusted from H/m to $(H + h)/m$. Then, the second-color image 108 matches the first-color image 107.

[0022] In the present invention, for example, to expose an image to the second-color printing plate, w_1 , w_2 , and h are read out as correction amounts set in accordance with the stretch amount of the printing paper sheet. Next, on the basis of the readout correction amounts, the image exposure start position is adjusted from (X_1, Y_1) to $(X_1 - w_1, Y_1)$. In addition, the pixel interval ΔX in the X-axis direction is adjusted from W/n to $(W + w_1 + w_2)/n$. The pixel interval ΔY in the Y-axis direction is adjusted from H/m to $(H + h)/m$.

[0023] Fig. 1 shows a control apparatus for an image exposure apparatus according to an embodiment of the present invention. Referring to Fig. 1, reference numeral 110 denotes an image position correction control apparatus; 111, a paper convey apparatus; 112-1, an image exposure apparatus for the first-color printing plate; 112-2, an image exposure apparatus for the second-color printing plate; 112-3, an image exposure apparatus for the third-color printing plate; 112-4, an image exposure apparatus for the fourth-color printing plate; and

113, an image data generation apparatus. The paper convey apparatus 111, image exposure apparatuses 112-1 to 112-4, and image data generation apparatus 113 are connected to the image position correction control apparatus 110.

[0024] The image position correction control apparatus 110 comprises a CPU (Central Processing Unit) 110a, a ROM (Read Only Memory) 110b, a RAM (Random Access Memory) 110c, an input device 110d constructed by switches and operation keys, a display device 110e, and an input/output device 110f formed from a flexible disk drive and the like. The CPU 110a operates in accordance with a program stored in the ROM 110b in advance. The input device 110d comprises a reference correction amount storage mode switch 110d1, exposure start switch 110d2, correction reference amount storage switch 110d3, unique correction amount storage mode switch 110d4, and fan-out registration correction switch 110d5. The input device 110d, display device 110e, and input/output device 110f are connected to a bus BUS1 through an I/O interface (I/F) 110g.

[0025] An image position data memory 110h for storing image position data, an image data memory 110i for storing image data, a reference correction amount memory 110j for storing reference correction amounts, a unique correction amount memory 110k for storing unique correction amounts in correspondence with each type of printing paper sheet, a coordinate/interval memory 110l for storing X-axis direction pixel interval and Y-axis direction pixel interval of images of the respective colors, an average distortion amount memory 110m for storing an average distortion amount, a sum correction amount memory 110n for storing correction amounts to be output to the paper convey apparatus, and a conversion table memory 110o for storing a conversion table which converts a distortion amount into a correction amount of the paper convey apparatus are connected to the bus BUS1.

[0026] The image data generation apparatus 113 is connected to the bus BUS1 through an I/O interface (I/F) 110p. The paper convey apparatus 111 and image exposure apparatuses 112-1 to 112-4 are connected to the bus BUS1 through an I/O interface (I/F) 110q. The image data generation apparatus 113 supplies to the image position correction control apparatus 110 the image data of an image to be exposed to the printing plate of each color. The image data supplied to the image position correction control apparatus 110 is stored in the memory 110i.

[0027] The paper convey apparatus 111 has a paper convey mechanism 111p having the same structure as that of the sheet-like object convey apparatus disclosed in reference 2. The paper convey apparatus 111 deflects the gripper shaft in the paper convey direction in gripping, with swing grippers, the end portion of a sheet-like object that is supplied from the convey direction at the time of conveying a paper sheet in accordance with rotation of a motor (to be described later), thereby correct-

ing the shape of the sheet-like object. When a printing paper sheet is transferred to a first-color printing unit 101-1 (Fig. 4) of the printing section, the paper convey mechanism 111p stretches the rear end portion of the printing paper sheet in the horizontal direction (a direction perpendicular to the paper convey direction) to deform in advance the paper into a trapezoidal shape whose width increases toward the leading edge side. As a result, the image after printing has an almost rectangular shape. For the arrangement of the paper convey mechanism 111p, the arrangement of the sheet-like object convey apparatus described in reference 2 is incorporated in this specification.

[0028] As shown in Fig. 2, the paper convey apparatus 111 comprises, in addition to the paper convey mechanism 111p, a CPU 111a, ROM 111b, RAM 111c, input device 111d, display device 111e, and input/output device 111f. The CPU 111a operates in accordance with a program stored in the ROM 111b. The input device 111d, display device 111e, and input/output device 111f are connected to a bus BUS2 through an I/O interface (I/F) 111h.

[0029] A correction motor 111j for the paper convey mechanism 111p, a motor driver 111k, a D/A converter 111l, a rotary encoder 111m, and a counter 111n are connected to the bus BUS2 through an I/O interface (I/F) 111i. A correction amount memory 111g for storing correction amounts is connected to the bus BUS2. As the motor 111j rotates, the press member (not shown) of the paper convey mechanism 111p displaces and deflects the gripper shaft (not shown).

[0030] The image exposure apparatuses 112-1 to 112-4 construct plate making apparatuses 102-1 to 102-4 shown in Fig. 4. The image exposure apparatuses expose images by irradiating printing plates (raw plates) mounted on the surfaces of plate cylinders 103-1 to 103-4 in printing units 101-1 to 101-4 with laser beams.

[0031] As shown in Fig. 3, each of the image exposure apparatuses 112-1 to 112-4 comprises a CPU 112a, ROM 112b, RAM 112c, and image exposure head 112d for exposing an image on a printing plate. The CPU 112a operates in accordance with a program stored in the ROM 112b in advance. The image exposure head 112d is connected to a bus BUS3 through an I/O interface (I/F) 112e. An image position memory 112f for storing image position data, and a coordinate/interval memory 112g for storing the X-coordinate of the left edge of an image to be exposed to the printing plate of each color and the X-axis direction pixel interval and Y-axis direction pixel interval of a color image are connected to the bus BUS3.

[Generation of Database]

[0032] At the beginning of operation, a database for various kinds of correction amounts (reference correction amounts and unique correction amounts for each type of printing paper sheet) is generated. This data-

base is generated in the following way.

[Generation of Reference Correction Amounts]

5 [0033] The operator turns on the reference correction amount storage mode switch 110d1 of the input device 110d at the start of database generation. When the reference correction amount storage mode switch 110d1 is turned on, the CPU 110a sets all data in the memory

10 110j to 0. The memory 110j stores reference correction amounts w1Fi, w2Fi, and hFi (i = 1 to 4) of the exposure positions of images of the respective colors and a reference correction amount s1F of the paper convey apparatus, as will be described later. All the reference correction amounts are reset to 0.

15 [0034] Next, the CPU 110a reads out image sizes "W" and "H" which are stored in the memory 110i together with image data. The CPU 110a calculates data (X1, Y1) of the accurate image position (exposure start position) and sets them in the memory 110h such that the W × H image matches the X-direction central position of the printing plate and the printing start position on the leading edge side.

20 [0035] The operator turns on the exposure start switch 110d2 of the input device 110d. When the exposure start switch 110d2 is turned on, the CPU 110a reads out, from the memory 110j, the reference correction amounts w1Fi, w2Fi, and hFi of the exposure position of images of the respective colors and the reference correction amount s1F of the paper convey apparatus. In this case, all the reference correction amounts w1Fi, w2Fi, hFi, and s1F of each color are 0.

25 [0036] The CPU 110a obtains the X-coordinate (X1 - w1Fi) of the left edge of the image to be exposed to the printing plate of each color on the basis of the readout reference correction amounts w1Fi, w2Fi, and hFi. The CPU 110a also obtains the pixel interval ΔX in the X-axis direction of the image of each color as $\Delta X = (W + w1Fi + w2Fi)/n$ and the pixel interval ΔY in the Y-axis direction

30 as $\Delta Y = (H + hFi)/m$. In this case, since the reference correction amounts w1Fi, w2Fi, and hFi of each color are 0, the X-coordinate of the left edge of the image to be exposed to the printing plate of each color is X1. The pixel interval ΔX in the X-axis direction of the image of each color is obtained as $\Delta X = W/n$. The pixel interval ΔY in the Y-axis direction is obtained as $\Delta Y = H/m$.

35 [0037] The CPU 110a stores, in the memory 1101, the obtained values, i.e., the X-coordinate X1 of the left edge of the image to be exposed to the printing plate of each plate, the pixel interval $\Delta X = W/n$ in the X-axis direction of the image of each color, and the pixel interval $\Delta Y = H/m$ in the Y-axis direction of the image of each color. The CPU 110a also sets identical data in the memory 112g of the image exposure apparatus 112 of each color. Next, the CPU 110a sets the data (X1, Y1) of the image position, which is stored in the memory 110h, in the memory 112f of the image exposure apparatus 112 of each color. The CPU 110a also sets the reference

correction amount $s1F$ (in this case, $s1F = 0$) read out from the memory 110j in the memory 111g of the paper convey apparatus 111.

[0038] In the image exposure apparatus 112 of each color, the CPU 112a reads out the image position data $(X1, Y1)$ set in the memory 112f, and the X-coordinate $X1$ of the left edge of the image to be exposed to the printing plate of a corresponding color, the pixel interval $\Delta X = W/n$ in the X-axis direction of the image of a corresponding color, and the pixel interval $\Delta Y = H/m$ in the Y-axis direction of the image of a corresponding color, which are set in the memory 112g. On the basis of the readout data, the exposure start position is set at $(X1, Y1)$. The image is exposed to the printing plate (raw plate) of each color at the interval $\Delta X = W/n$ in the X-axis direction and at the interval $\Delta Y = H/m$ in the Y-axis direction.

[0039] The operator executes four-color printing on a reference printing paper sheet using the printing plates of the respective colors with the exposed images. After printing, the operator checks the image printed on the reference printing paper sheet and obtains the correction amount $s1F$ of the paper convey apparatus 111 which prevents any shift in the distortion direction. The obtained correction amount $s1F$ is set in the memory 110j of the image position correction control apparatus 110.

[0040] Next, shift amounts $w1F2$ and $w2F2$ in the horizontal direction and a shift amount $hF2$ in the vertical direction between the first-color image and the second-color image are obtained. In addition, shift amounts $w1F3$ and $w2F3$ in the horizontal direction and a shift amount $hF3$ in the vertical direction between the first-color image and the third-color image are obtained. Also, shift amounts $w1F4$ and $w2F4$ in the horizontal direction and a shift amount $hF4$ in the vertical direction between the first-color image and the fourth-color image are obtained. The obtained shift amounts are set in the memory 110j of the image position correction control apparatus 110.

[0041] Then, the operator exchanges the printing plates to which the second-, third-, and fourth-color images are exposed with raw plates and turns on the exposure start switch 110d2 of the input device 110d. When the exposure start switch 110d2 is turned on, the CPU 110a reads out, from the memory 110j, the reference correction amounts $w1F2$, $w2F2$, and $hF2$, the reference correction amounts $w1F3$, $w2F3$, and $hF3$, the reference correction amounts $w1F4$, $w2F4$, and $hF4$, and the reference correction amount $s1F$ of the paper convey apparatus.

[0042] On the basis of the readout reference correction amounts $w1F2$, $w2F2$, and $hF2$, the CPU 110a obtains the X-coordinate of the left edge of the image to be exposed to the second-color printing plate as $(X1 - w1F2)$. The CPU 110a also obtains the pixel interval $\Delta X = (W + w1F2 + w2F2)/n$ and the pixel interval ΔY in the

Y-axis direction as $\Delta Y = (H + hF2)/m$.

[0043] Similarly, on the basis of the readout reference correction amounts $w1F3$, $w2F3$, and $hF3$, the CPU 110a obtains the X-coordinate of the left edge of the image to be exposed to the third-color printing plate as $(X1 - w1F3)$. The CPU 110a also obtains the pixel interval ΔX in the X-axis direction of the third-color image as $\Delta X = (W + w1F3 + w2F3)/n$ and the pixel interval ΔY in the Y-axis direction as $\Delta Y = (H + hF3)/m$.

[0044] Similarly, on the basis of the readout reference correction amounts $w1F4$, $w2F4$, and $hF4$, the CPU 110a obtains the X-coordinate of the left edge of the image to be exposed to the fourth-color printing plate as $(X1 - w1F4)$. The CPU 110a also obtains the pixel interval ΔX in the X-axis direction of the fourth-color image as $\Delta X = (W + w1F4 + w2F4)/n$ and the pixel interval ΔY in the Y-axis direction as $\Delta Y = (H + hF4)/m$.

[0045] The CPU 110a sets the readout reference correction amount $s1F$ of the paper convey apparatus in the memory 111g of the paper convey apparatus 111. The CPU 110a also sets the X-coordinate $(X1 - w1F2)$, the pixel interval $\Delta X = (W + w1F2 + w2F2)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF2)/m$ in the Y-axis direction of the second-color image in the

memory 112g of the image exposure apparatus 112-2. In a similar way, the CPU 110a sets the X-coordinate $(X1 - w1F3)$, the pixel interval $\Delta X = (W + w1F3 + w2F3)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF3)/m$ in the Y-axis direction of the third-color image

in the memory 112g of the image exposure apparatus 112-3. The CPU 110a also sets the X-coordinate $(X1 - w1F4)$, the pixel interval $\Delta X = (W + w1F4 + w2F4)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF4)/m$ in the Y-axis direction of the fourth-color image in the

memory 112g of the image exposure apparatus 112-4.

[0046] In the image exposure apparatus 112-2, the CPU 112a reads out the image position data $(X1, Y1)$ in the memory 112f, and the X-coordinate $(X1 - w1F2)$ of the left edge of the image to be exposed to the printing plate, the pixel interval $\Delta X = (W + w1F2 + w2F2)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF2)/m$ in the Y-axis direction, which are set in the memory 112g. On the basis of the readout data, the CPU 112a sets the exposure start position at $(X1 - w1F2, Y1)$. The image is exposed to the second-color printing plate at the interval $\Delta X = (W + w1F2 + w2F2)/n$ in the X-axis direction and at the interval $\Delta Y = (H + hF2)/m$ in the Y-axis direction.

[0047] Similarly, in the image exposure apparatus 112-3, the CPU 112a reads out the image position data $(X1, Y1)$ in the memory 112f, and the X-coordinate $(X1 - w1F3)$ of the left edge of the image to be exposed to the printing plate, the pixel interval $\Delta X = (W + w1F3 + w2F3)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF3)/m$ in the Y-axis direction, which are set in the memory 112g. On the basis of the readout data, the CPU 112a sets the exposure start position at $(X1 - w1F3, Y1)$. The image is exposed to the third-color printing plate at

the interval $\Delta X = (W + w1F3 + w2F3)/n$ in the X-axis direction and at the interval $\Delta Y = (H + hF3)/m$ in the Y-axis direction.

[0048] In addition, in the image exposure apparatus 112-4, the CPU 112a reads out the image position data (X1, Y1) in the memory 112f, and the X-coordinate (X1 - w1F4) of the left edge of the image to be exposed to the printing plate, the pixel interval $\Delta X = (W + w1F4 + w2F4)/n$ in the X-axis direction, and the pixel interval $\Delta Y = (H + hF4)/m$ in the Y-axis direction, which are set in the memory 112g. On the basis of the readout data, the CPU 112a sets the exposure start position at (X1 - w1F4, Y1). The image is exposed to the fourth-color printing plate at the interval $\Delta X = (W + w1F4 + w2F4)/n$ in the X-axis direction and at the interval $\Delta Y = (H + hF4)/m$ in the Y-axis direction.

[0049] The operator executes four-color printing on a reference printing paper sheet using the second- to fourth-color printing plates with the exposed images, and the first-color printing plate with the already exposed image. In printing, when the printing paper sheet is transferred to the printing section, the paper convey apparatus 111 reads out the reference correction amount s1F set in the memory 111g and stretches the rear end portion of the printing paper sheet in the horizontal direction on the basis of the readout reference correction amount s1F, thereby deforming in advance the printing paper sheet into a trapezoidal shape whose width increases toward the trailing edge side.

[0050] After printing, the operator checks the image printed on the reference printing paper sheet. If the misregistration between the colors falls within the allowable range, the correction reference amount storage switch 110d3 of the input device 110d is turned on to determine the reference correction amounts w1Fi, w2Fi, hFi, and s1F of the respective colors in the memory 110j. If the misregistration between the colors falls outside the allowable range, the above-described operation is repeated until the misregistration falls within the allowable range.

[Generation of Unique Correction Amounts for Each Type of Printing Paper Sheet]

[0051] After the above-described reference correction amount generation, the operator turns on the unique correction amount storage mode switch 110d4 of the input device 110d. When the unique correction amount storage mode switch 110d4 is turned on, the CPU 110a resets all data in the memory 110k to 0. The memory 110k stores unique correction amounts w1i, w2i, and hi (i = 1 to 4) of the exposure positions of images of the respective colors in correspondence with each type of printing paper sheet and unique distortion amounts s1i and s2i of the respective colors in correspondence with each type of printing paper sheet, as will be described later. All the unique values are reset to 0.

[0052] After that, the operator executes four-color

printing on a printing paper sheet (a printing paper sheet is to be used, which is of a type different from the reference printing paper sheet) other than the reference printing paper sheet using the printing plates of the respective colors. The operator checks the image printed on the printing paper sheet of a different type and obtains shift amounts w12 and w22 in the horizontal direction and a shift amount h2 in the vertical direction between the first-color image and the second-color image.

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 3230 3235 3240 3245 3250 3255 3260 3265 3270 3275 3280 3285 3290 3295 3300 3305 3310 3315 3320 3325 3330 3335 3340 3345 3350 3355 3360 3365 3370 3375 3380 3385 3390 3395 3400 3405 3410 3415 3420 3425 3430 3435 3440 3445 3450 3455 3460 3465 3470 3475 3480 3485 3490 3495 3500 3505 3510 3515 3520 3525 3530 3535 3540 3545 3550 3555 3560 3565 3570 3575 3580 3585 3590 3595 3600 3605 3610 3615 3620 3625 3630 3635 3640 3645 3650 3655 3660 3665 3670 3675 3680 3685 3690 3695 3700 3705 3710 3715 3720 3725 3730 3735 3740 3745 3750 3755 3760 3765 3770 3775 3780 3785 3790 3795 3800 3805 3810 3815 3820 3825 3830 3835 3840 3845 3850 3855 3860 3865 3870 3875 3880 3885 3890 3895 3900 3905 3910 3915 3920 3925 3930 3935 3940 3945 3950 3955 3960 3965 3970 3975 3980 3985 3990 3995 4000 4005 4010 4015 4020 4025 4030 4035 4040 4045 4050 4055 4060 4065 4070 4075 4080 4085 4090 4095 4100 4105 4110 4115 4120 4125 4130 4135 4140 4145 4150 4155 4160 4165 4170 4175 4180 4185 4190 4195 4200 4205 4210 4215 4220 4225 4230 4235 4240 4245 4250 4255 4260 4265 4270 4275 4280 4285 4290 4295 4300 4305 4310 4315 4320 4325 4330 4335 4340 4345 4350 4355 4360 4365 4370 4375 4380 4385 4390 4395 4400 4405 4410 4415 4420 4425 4430 4435 4440 4445 4450 4455 4460 4465 4470 4475 4480 4485 4490 4495 4500 4505 4510 4515 4520 4525 4530 4535 4540 4545 4550 4555 4560 4565 4570 4575 4580 4585 4590 4595 4600 4605 4610 4615 4620 4625 4630 4635 4640 4645 4650 4655 4660 4665 4670 4675 4680 4685 4690 4695 4700 4705 4710 4715 4720 4725 4730 4735 4740 4745 4750 4755 4760 4765 4770 4775 4780 4785 4790 4795 4800 4805 4810 4815 4820 4825 4830 4835 4840 4845 4850 4855 4860 4865 4870 4875 4880 4885 4890 4895 4900 4905 4910 4915 4920 4925 4930 4935 4940 4945 4950 4955 4960 4965 4970 4975 4980 4985 4990 4995 5000 5005 5010 5015 5020 5025 5030 5035 5040 5045 5050 5055 5060 5065 5070 5075 5080 5085 5090 5095 5100 5105 5110 5115 5120 5125 5130 5135 5140 5145 5150 5155 5160 5165 5170 5175 5180 5185 5190 5195 5200 5205 5210 5215 5220 5225 5230 5235 5240 5245 5250 5255 5260 5265 5270 5275 5280 5285 5290 5295 5300 5305 5310 5315 5320 5325 5330 5335 5340 5345 5350 5355 5360 5365 5370 5375 5380 5385 5390 5395 5400 5405 5410 5415 5420 5425 5430 5435 5440 5445 5450 5455 5460 5465 5470 5475 5480 5485 5490 5495 5500 5505 5510 5515 5520 5525 5530 5535 5540 5545 5550 5555 5560 5565 5570 5575 5580 5585 5590 5595 5600 5605 5610 5615 5620 5625 5630 5635 5640 5645 5650 5655 5660 5665 5670 5675 5680 5685 5690 5695 5700 5705 5710 5715 5720 5725 5730 5735 5740 5745 5750 5755 5760 5765 5770 5775 5780 5785 5790 5795 5800 5805 5810 5815 5820 5825 5830 5835 5840 5845 5850 5855 5860 5865 5870 5875 5880 5885 5890 5895 5900 5905 5910 5915 5920 5925 5930 5935 5940 5945 5950 5955 5960 5965 5970 5975 5980 5985 5990 5995 6000 6005 6010 6015 6020 6025 6030 6035 6040 6045 6050 6055 6060 6065 6070 6075 6080 6085 6090 6095 6100 6105 6110 6115 6120 6125 6130 6135 6140 6145 6150 6155 6160 6165 6170 6175 6180 6185 6190 6195 6200 6205 6210 6215 6220 6225 6230 6235 6240 6245 6250 6255 6260 6265 6270 6275 6280 6285 6290 6295 6300 6305 6310 6315 6320 6325 6330 6335 6340 6345 6350 6355 6360 6365 6370 6375 6380 6385 6390 6395 6400 6405 6410 6415 6420 6425 6430 6435 6440 6445 6450 6455 6460 6465 6470 6475 6480 6485 6490 6495 6500 6505 6510 6515 6520 6525 6530 6535 6540 6545 6550 6555 6560 6565 6570 6575 6580 6585 6590 6595 6600 6605 6610 6615 6620 6625 6630 6635 6640 6645 6650 6655 6660 6665 6670 6675 6680 6685 6690 6695 6700 6705 6710 6715 6720 6725 6730 6735 6740 6745 6750 6755 6760 6765 6770 6775 6780 6785 6790 6795 6800 6805 6810 6815 6820 6825 6830 6835 6840 6845 6850 6855 6860 6865 6870 6875 6880 6885 6890 6895 6900 6905 6910 6915 6920 6925 6930 6935 6940 6945 6950 6955 6960 6965 6970 6975 6980 6985 6990 6995 7000 7005 7010 7015 7020 7025 7030 7035 7040 7045 7050 7055 7060 7065 7070 7075 7080 7085 7090 7095 7100 7105 7110 7115 7120 7125 7130 7135 7140 7145 7150 7155 7160 7165 7170 7175 7180 7185 7190 7195 7200 7205 7210 7215 7220 7225 7230 7235 7240 7245 7250 7255 7260 7265 7270 7275 7280 7285 7290 7295 7300 7305 7310 7315 7320 7325 7330 7335 7340 7345 7350 7355 7360 7365 7370 7375 7380 7385 7390 7395 7400 7405 7410 7415 7420 7425 7430 7435 7440 7445 7450 7455 7460 7465 7470 7475 7480 7485 7490 7495 7500 7505 7510 7515 7520 7525 7530 7535 7540 7545 7550 7555 7560 7565 7570 7575 7580 7585 7590 7595 7600 7605 7610 7615 7620 7625 7630 7635 7640 7645 7650 7655 7660 7665 7670 7675 7680 7685 7690 7695 7700 7705 7710 7715 7720 7725 7730 7735 7740 7745 7750 7755 7760 7765 7770 7775 7780 7785 7790 7795 7800 7805 7810 7815 7820 7825 7830 7835 7840 7845 7850 7855 7860 7865 7870 7875 7880 7885 7890 7895 7900 7905 7910 7915 7920 7925 7930 7935 7940 7945 7950 7955 7960 7965 7970 7975 7980 7985 7990 7995 8000 8005 8010 8015 8020 8025 8030 8035 8040 8045 8050 8055 8060 8065 8070 8075 8080 8085 8090 8095 8100 8105 8110 8115 8120 8125 8130 8135 8140 8145 8150 8155 8160 8165 8170 8175 8180 8185 8190 8195 8200 8205 8210 8215 8220 8225 8230 8235 8240 8245 8250 8255 8260 8265 8270 8275 8280 8285 8290 8295 8300 8305 8310 8315 8320 8325 8330 8335 8340 8345 8350 8355 8360 8365 8370 8375 8380 8385 8390 8395 8400 8405 8410 8415 8420 8425 8430 8435 8440 8445 8450 8455 8460 8465 8470 8475 8480 8485 8490 8495 8500 8505 8510 8515 8520 8525 8530 8535 8540 8545 8550 8555 8560 8565 8570 8575 8580 8585 8590 8595 8600 8605 8610 8615 8620 8625 8630 8635 8640 8645 8650 8655 8660 8665 8670 8675 8680 8685 8690 8695 8700 8705 8710 8715 8720 8725 8730 8735 8740 8745 8750 8755 8760 8765 8770 8775 8780 8785 8790 8795 8800 8805 8810 8815 8820 8825 8830 8835 8840 8845 8850 8855 8860 8865 8870 8875 8880 8885 8890 8895 8900 8905 8910 8915 8920 8925 8930 8935 8940 8945 8950 8955 8960 8965 8970 8975 8980 8985 8990 8995 9000 9005 9010 9015 9020 9025 9030 9035 9040 9045 9050 9055 9060 9065 9070 9075 9080 9085 9090 9095 9100 9105 9110 9115 9120 9125 9130 9135 9140 9145 9150 9155 9160 9165 9170 9175 9180 9185 9190 9195 9200 9205 9210 9215 9220 9225 9230 9235 9240 9245 9250 9255 9260 9265 9270 9275 9280 9285 9290 9295 9300 9305 9310 9315 9320 9325 9330 9335 9340 9345 9350 9355 9360 9365 9370 9375 9380 9385 9390 9395 9400 9405 9410 9415 9420 9425 9430 9435 9440 9445 9450 9455 9460 9465 9470 9475 9480 9485 9490 9495 9500 9505 9510 9515 9520 9525 9530 9535 9540 9545 9550 9555 9560 9565 9570 9575 9580 9585 9590 9595 9600 9605 9610 9615 9620 9625 9630 9635 9640 9645 9650 9655 9660 9665 9670 9675 9680 9685 9690 9695 9700 9705 9710 9715 9720 9725 9730 9735 9740 9745 9750 9755 9760 9765 9770 9775 9780 9785 9790 9795 9800 9805 9810 9815 9820 9825 9830 9835 9840 9845 9850 9855 9860 9865 9870 9875 9880 9885 9890 9895 9900 9905 9910 9915 9920 9925 9930 9935 9940 9945 9950 9955 9960 9965 9970 9975 9980 9985 9990 9995 10000 10005 10010 10015 10020 10025 10030 10035 10040 10045 10050 10055 10060 10065 10070 10075 10080 10085 10090 10095 10100 10105 10110 10115 10120 10125 10130 10135 10140 10145 10150 10155 10160 10165 10170 10175 10180 10185 10190 10195 10200 10205 10210 10215 10220 10225 10230 10235 10240 10245 10250 10255 10260 10265 10270 10275 10280 10285 10290 10295

distortion amounts $s1i$ and $s2i$ of the respective colors in correspondence with the input printing paper sheet type.

[0057] The CPU 110a obtains the X-coordinate ($X1 - w1Fi - w1i$) of the left edge of the image to be exposed to the printing plate of each color on the basis of the readout reference correction amounts $w1Fi$, $w2Fi$, and hFi and unique correction amounts $w1i$, $w2i$, and hi . The CPU 110a also obtains the pixel interval ΔX in the X-axis direction of the image of each color as $\Delta X = (W + w1Fi + w2Fi + w1i + w2i)/n$ and the pixel interval ΔY in the Y-axis direction as $\Delta Y = (H + hFi + hi)/m$.

[0058] The CPU 110a stores, in the memory 1101, the obtained value, i.e., the X-coordinate ($X1 - w1Fi - w1i$) of the left edge of the image to be exposed to the printing plate of each color, the pixel interval $\Delta X = (W + w1Fi + w2Fi + w1i + w2i)/n$ in the X-axis direction of the image of each color, and the pixel interval $\Delta Y = (H + hFi + hi)/m$ in the Y-axis direction of the image of each color. The CPU 110a also sets these data in the memory 112g of the image exposure apparatus 112 of each color. Next, the CPU 110a sets the data ($X1, Y1$) of the image position, which is set in the memory 110h, in the memory 112f of the image exposure apparatus 112 of each color.

[0059] In the image exposure apparatus 112 of each color, the CPU 112a reads out the image position data ($X1, Y1$) set in the memory 112f, and the X-coordinate ($X1 - w1Fi - w1i$) of the left edge of the image to be exposed to the printing plate of a corresponding color, the pixel interval $\Delta X = (W + w1Fi + w2Fi + w1i + w2i)/n$ in the X-axis direction of the image of a corresponding color, and the pixel interval $\Delta Y = (H + hFi + hi)/m$ in the Y-axis direction, which are set in the memory 112g. On the basis of the readout data, the CPU 112a sets the exposure start position at ($X1, Y1$). The image is exposed to the printing plate (raw plate) of each color at the interval $\Delta X = (W + w1Fi + w2Fi + w1i + w2i)/n$ in the X-axis direction and at the interval $\Delta Y = (H + hFi + hi)/m$ in the Y-axis direction.

[0060] In the image position correction control apparatus 110, the CPU 110a reads out, from the memory 110k, the unique distortion amounts $s1i$ and $s2i$ of each color in correspondence with the type of printing paper sheet and obtains an average distortion amount $(s1i + s2i)/2$ of each color. Next, from the average distortion amount $(s1i + s2i)/2$ of each color, the CPU 110a obtains a unique correction amount $s1$ of the paper convey apparatus in correspondence with the type of printing paper sheet using a conversion table which is stored in the memory 110o and converts the distortion amount into the correction amount of the paper convey apparatus. The CPU 110a obtains a sum $(s1F + s1)$ of the obtained unique correction amount $s1$ and the reference correction amount $s1F$ stored in the memory 110j for storing reference correction amounts and stores the sum in the memory 110n. The CPU 110a sets this data in the memory 111g of the paper convey apparatus 111.

[0061] After that, the operator executes four-color

printing on the printing paper sheet whose type is input in the preceding step, using the printing plates of the respective colors with the exposed images. During printing, when the printing paper sheet is transferred to the printing section, the paper convey apparatus 111 stretches the rear end portion of the printing paper sheet in the horizontal direction on the basis of the correction amount $(s1F + s1)$ which is stored in the memory 111g in correspondence with the printing paper sheet, thereby deforming in advance the printing paper sheet into a trapezoidal shape whose width increases toward the trailing edge side.

[0062] The image is printed on the printing paper sheet which is deformed into the trapezoidal shape with a width increasing toward the trailing edge side. Hence, stretching of the printing paper sheet during printing is eliminated or reduced, and the shift of the image due to distortion by the stretch of the printing paper sheet during printing is eliminated or reduced. For this reason, a normal printing product can be obtained.

[0063] To the contrary, when the image data (image "1"/non-image "0") of each pixel is paired with the data of its exposure position and stored, and only the exposure position of each image is corrected, the resultant printing product has an image with a trapezoidal distortion as shown in Fig. 8. Hence, no normal printing product can be obtained.

[0064] According to this embodiment, since correction in the distortion direction is done using the image position correction control apparatus 110, only correction in the horizontal and vertical directions needs to be executed in exposing the image data of each pixel to the printing plate. For this reason, only the reference correction amounts $w1Fi$, $w2Fi$, hFi , and $s1F$ and unique correction amounts $w1i$, $w2i$, hi , $s1i$, and $s2i$ corresponding to the type of printing paper sheet need to be stored. Hence, a small storage capacity suffices. In addition, since only the X-coordinate of the left edge of the image to be exposed to the printing plate and the X-axis direction pixel interval and Y-axis direction pixel interval of the image need to be corrected, processing can easily be done in a short time.

[0065] This applies not only to a case wherein the paper convey apparatus is automatically controlled using the motor for the paper convey apparatus, as described in the above embodiment, but also to a case wherein the operator manually operates the paper convey apparatus.

[0066] In this embodiment, the reference correction amounts $w1Fi$, $w2Fi$, and hFi ($i = 1$ to 4) of the exposure positions of images of all the four colors are stored in the memory 110j. In addition, the unique correction amounts $w1i$, $w2i$, and hi ($i = 1$ to 4) of the exposure positions of images of all the four colors are stored in the memory 110k in correspondence with the type of printing paper sheet. However, the correction amounts $w1F$, $w2F$, and hF of the first-color image or the unique correction amounts $w11$, $w21$, and $h1$ of the first-color

image corresponding to the type of printing paper sheet need not always be stored. That is, the reference correction amounts and unique correction amounts of the first-color image are always 0. Hence, when the image is to be exposed to the first-color printing plate, (X_1, Y_1) is used as the exposure start position, $\Delta X = W/n$ is used as the pixel interval in the X-axis direction, and $\Delta Y = H/m$ is used as the pixel interval in the Y-axis direction.

[0067] In this embodiment, plate making is executed on the printing press as plate making on press. However, the present invention can also be applied to a case wherein an image is exposed to a printing plate by a dedicated plate making machine separated from a printing press, and then, printing is executed by attaching the printing plate with the exposed image to the printing press.

[0068] In this embodiment, correction amounts are supplied from the image position correction control apparatus 110 to the paper convey apparatus 111. However, correction amounts to the paper convey apparatus 111 may be manually set as input values from the operator.

[0069] As has been described above, according to the present invention, in exposing an image to a printing plate, correction amounts set in accordance with the stretch amount of a printing paper sheet are read out, and the exposure position of each pixel of the image is adjusted on the basis of the correction amounts. With this arrangement, when the exposure start position (X_1, Y_1) of the image on the printing plate, the pixel interval ΔX in the X-axis direction, and the pixel interval ΔY in the Y-axis direction are adjusted, any misregistration between the colors due to stretch of the printing paper sheet can be eliminated, and any defective printing product can be prevented.

Claims

1. An image exposure control apparatus characterized by comprising:

memory means (110j, 110k) for storing a correction amount for each color in accordance with a stretch amount of a printing paper sheet in multicolor printing operation; and adjustment means (110a) for adjusting an exposure position of a pixel of an image to be exposed for each color, on the basis of the correction amount read out from said memory means, in exposing the image on a printing plate.

2. An apparatus according to claim 1, further comprising distortion preventing means (111) for deforming a trailing edge side of the printing paper sheet before start of printing, thereby preventing distortion of a shape of the image after printing.

3. An apparatus according to claim 2, wherein said distortion preventing means comprises

5 a motor (111j) which rotates in accordance with the set correction amount, and a paper convey mechanism (111p) which stretches in advance the trailing edge side of the printing paper sheet as said motor rotates at the time of conveying the paper.

10 4. An apparatus according to claim 1, wherein said memory means comprises

15 a first memory which stores a reference correction amount for each color in correspondence with a stretch amount of a reference paper sheet, and

20 a second memory which stores a unique correction amount set in correspondence with a type of printing paper sheet, and said adjustment means adjusts the image exposure position on the basis of a value obtained by adding the reference correction amount and unique correction amount, which are respectively read out from said first and second memories.

25 5. An apparatus according to claim 4, wherein, as the reference correction amount for each color, said first memory stores a shift amount between an image of a first color and each of images of second and subsequent colors, which are printed on the reference printing paper sheets using the printing plates for respective colors, to which the image is exposed on the basis of image data and image position data obtained from an image size and the number of pixels in the image.

30 6. An apparatus according to claim 4, wherein, as the unique correction amount, said second memory stores a shift amount between an image of a first color and each of images of second and subsequent colors, which are printed on all printing paper sheets to be used, using the printing plates for respective colors, to which the image is exposed on the basis of image data and image position data obtained from an image size and the number of pixels in the image.

35 50 7. An apparatus according to claim 1, wherein said adjustment means adjusts, as the image exposure position, an image exposure start position and a pixel interval.

55 8. An apparatus according to claim 7, wherein said adjustment means adjusts, as the image exposure position, the image exposure start position in an X-axis direction and pixel intervals in the X- and Y-axis di-

rections.

9. An image exposure control apparatus **characterized by** comprising:

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memory means (110j, 110k) for storing a correction amount in accordance with a stretch amount of a printing paper sheet in printing operation; and
adjustment means (110a) for adjusting an exposure position of a pixel of an image to be exposed, on the basis of the correction amount read out from said memory means, in exposing the image on a printing plate.

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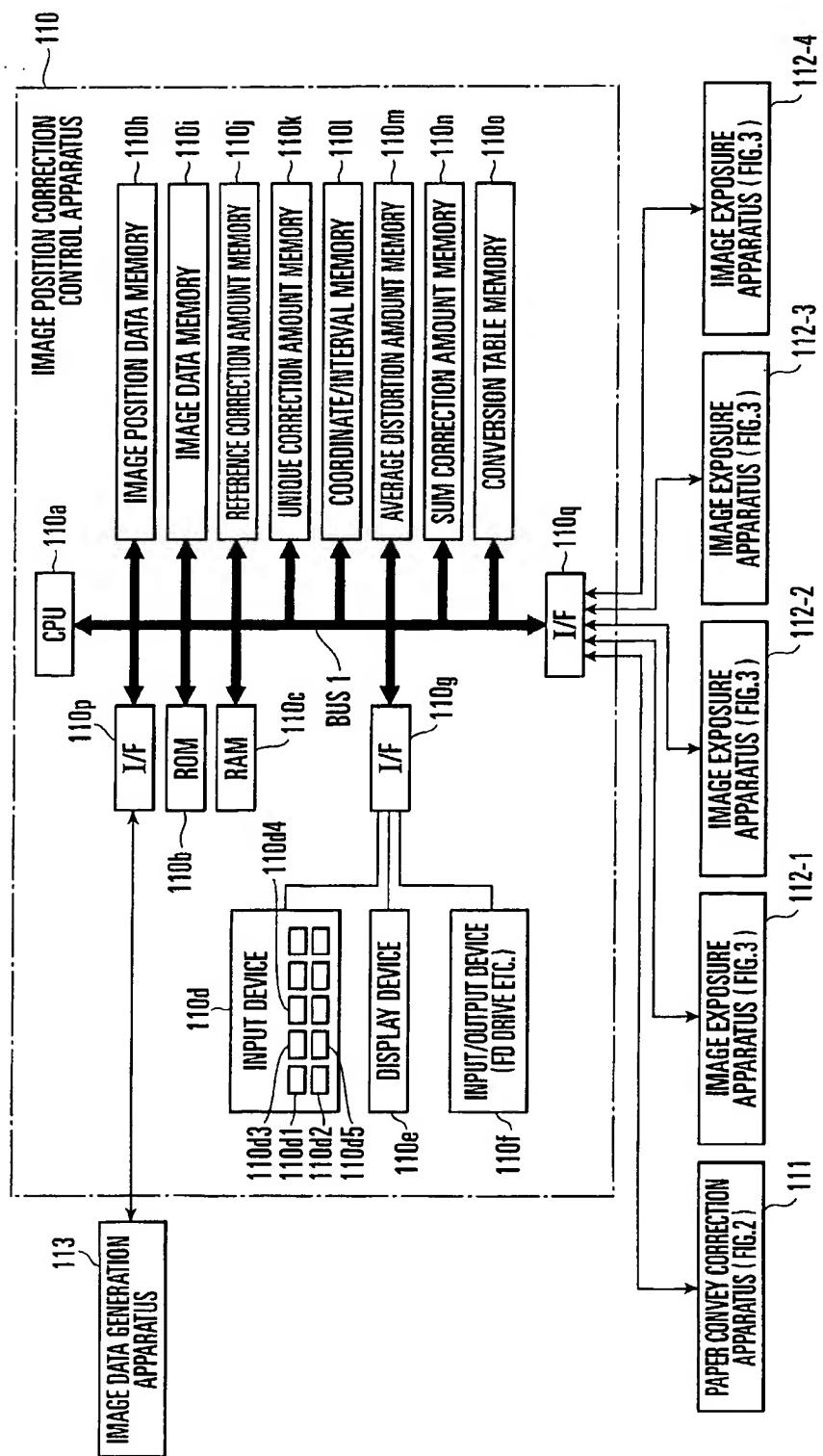


FIG. 1

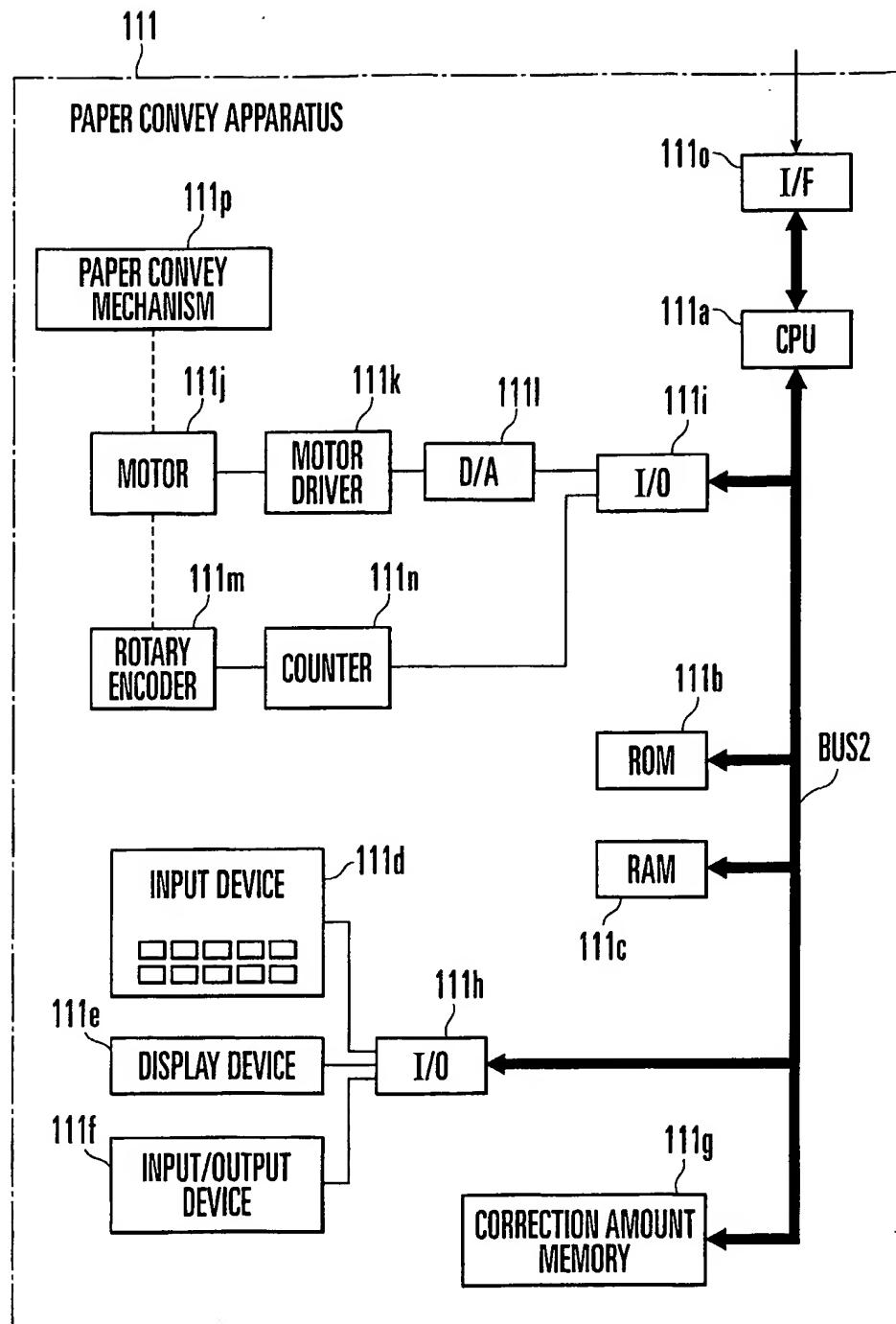


FIG. 2

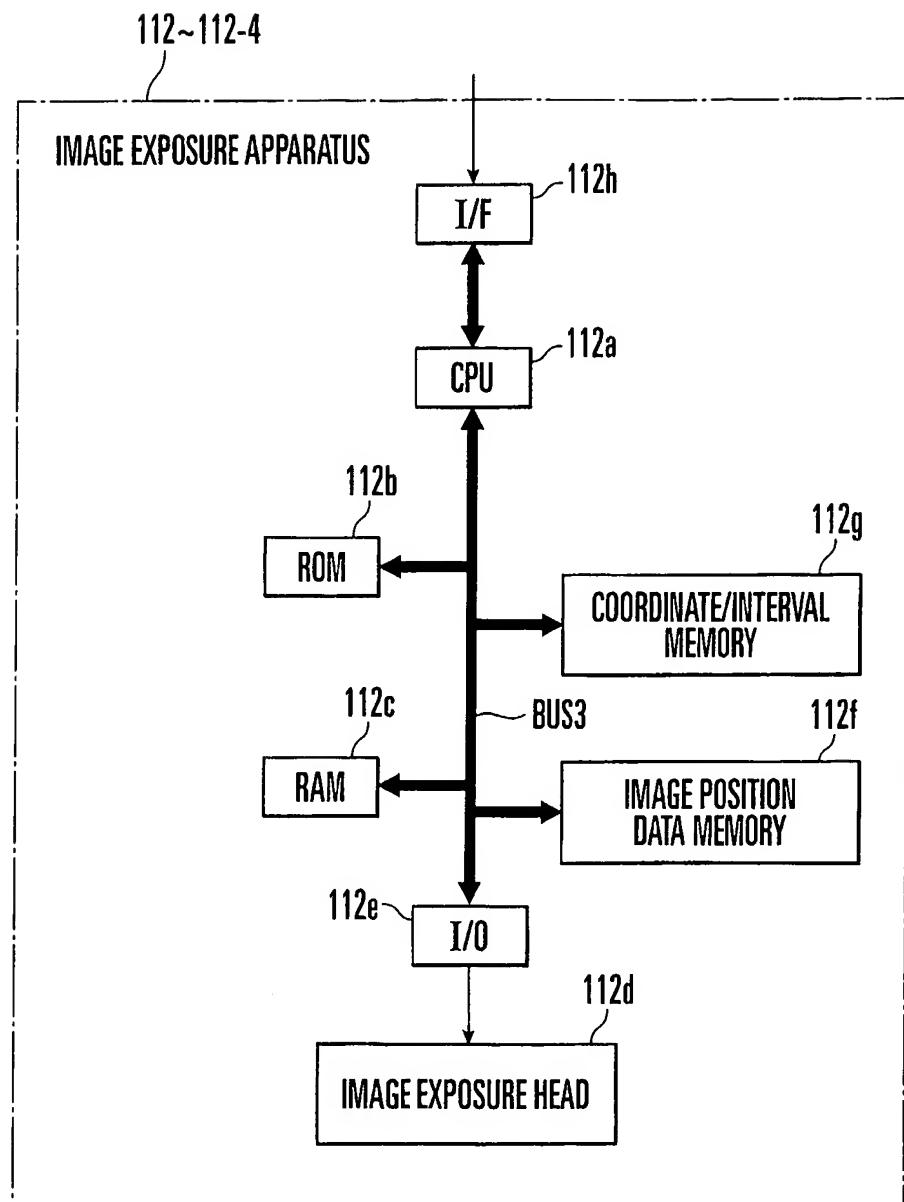


FIG. 3

FIG. 4

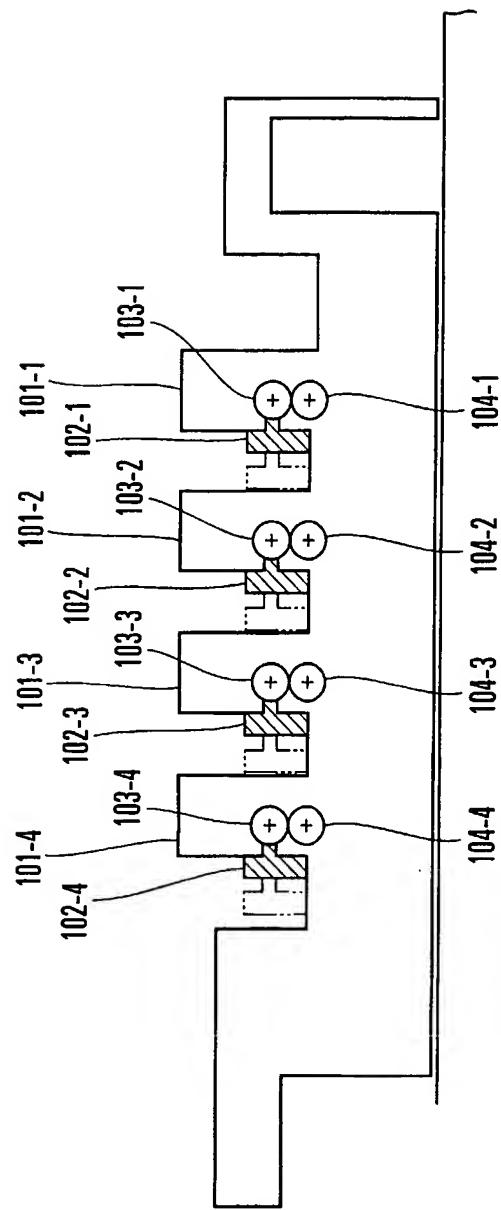
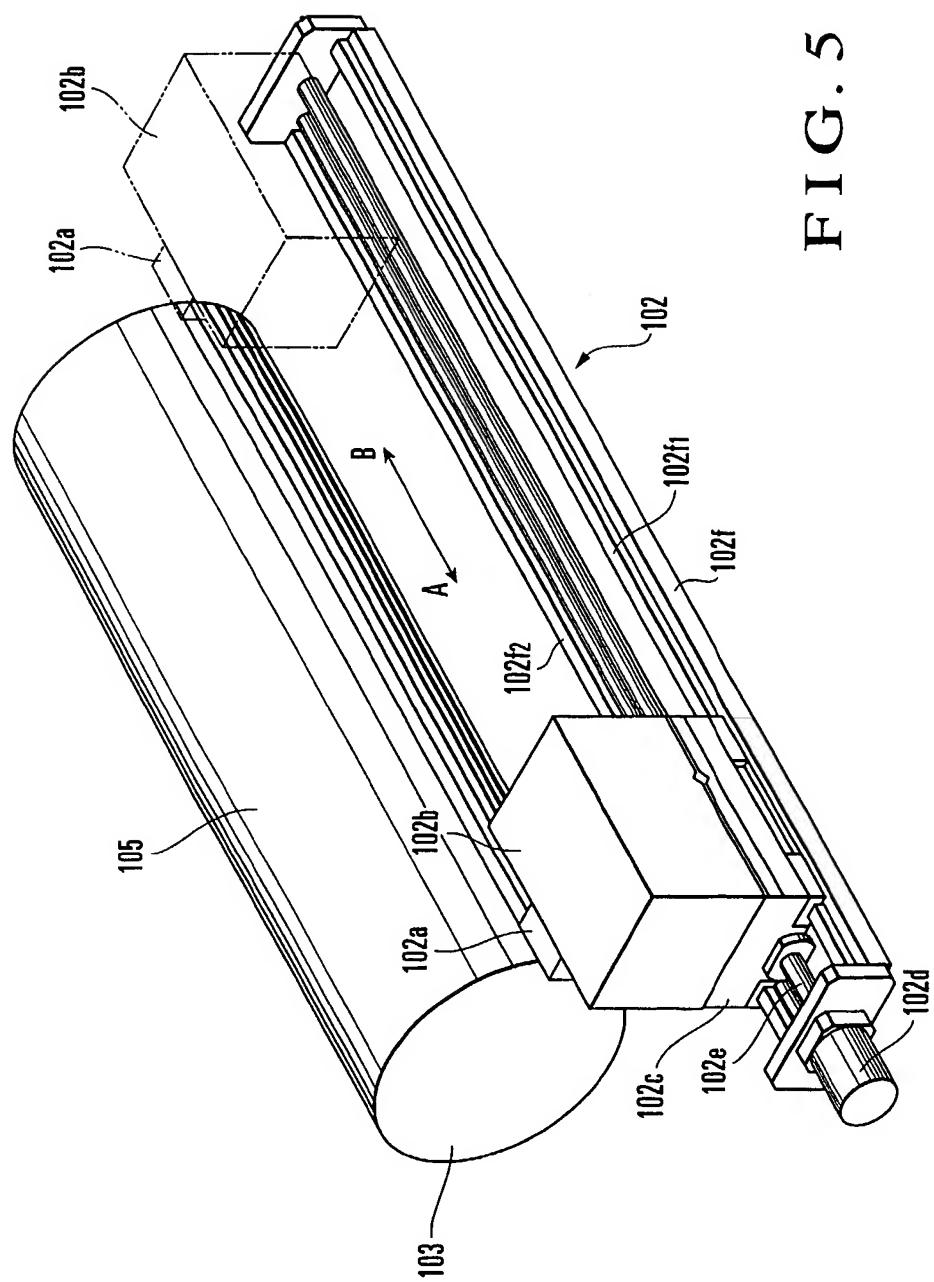


FIG. 5



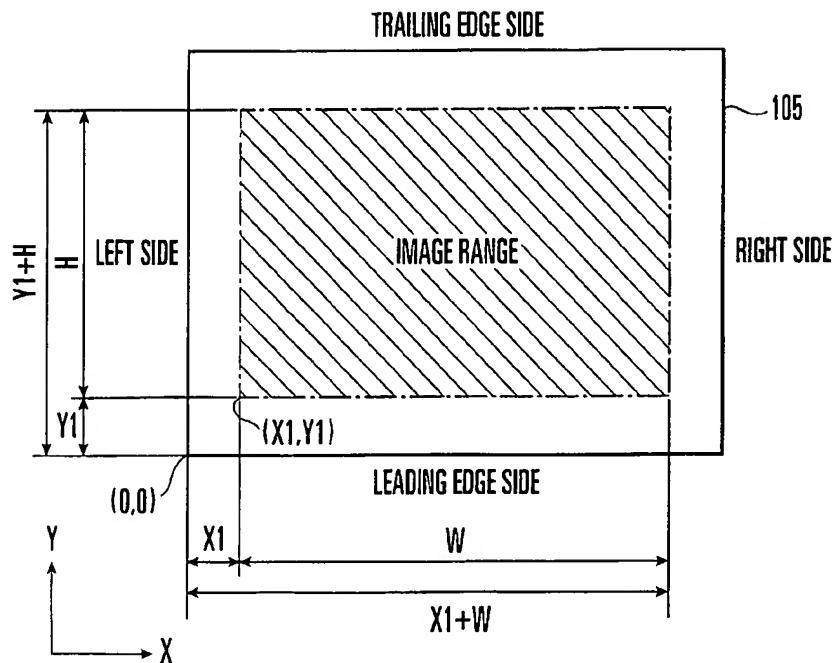


FIG. 6

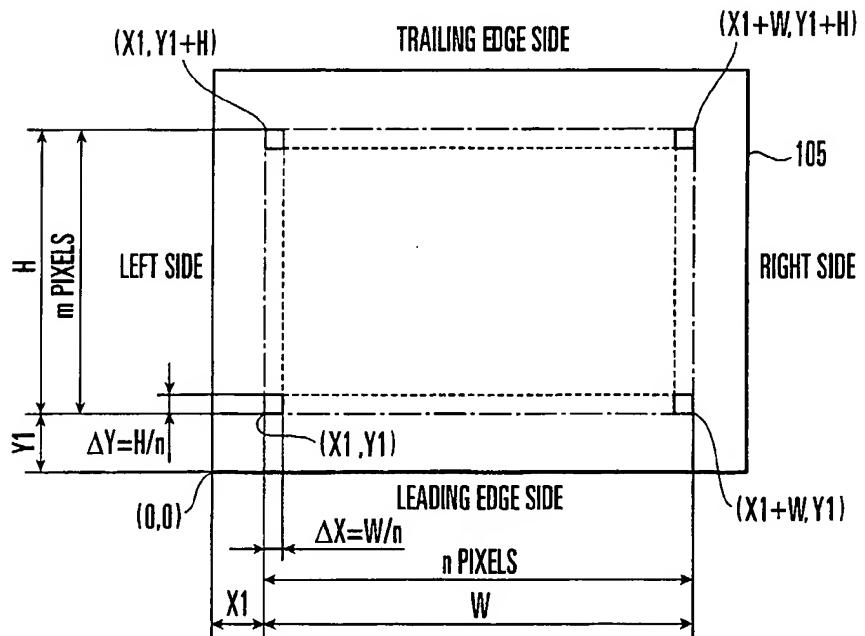


FIG. 7

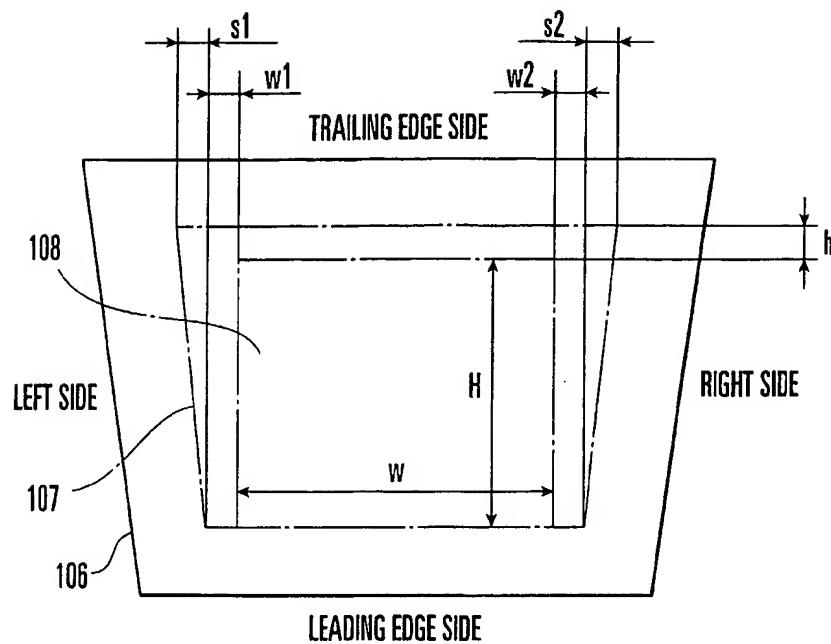


FIG. 8

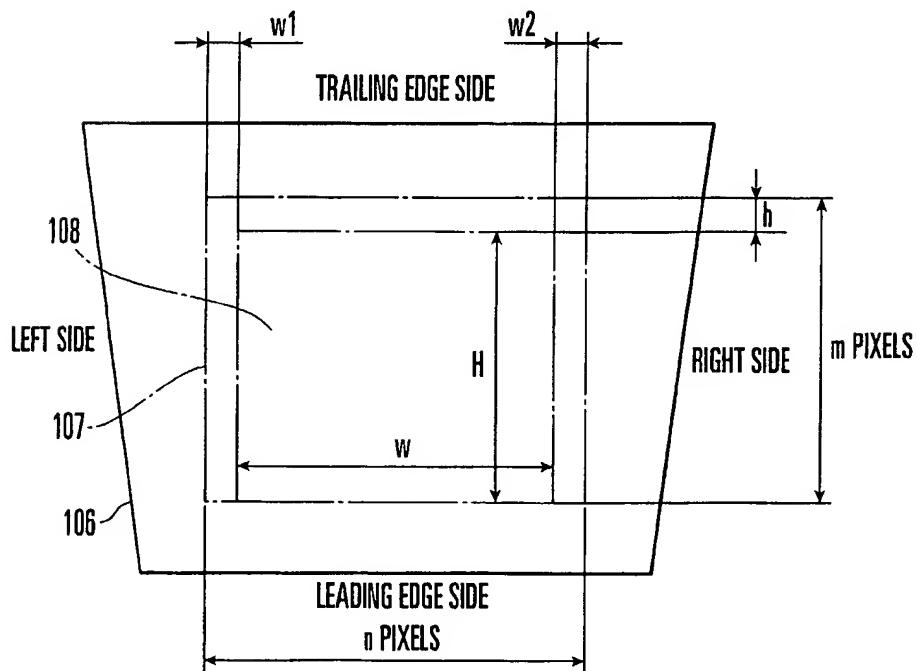


FIG. 9

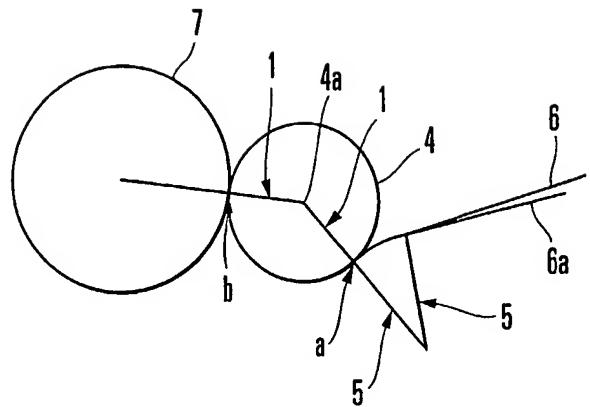


FIG. 10

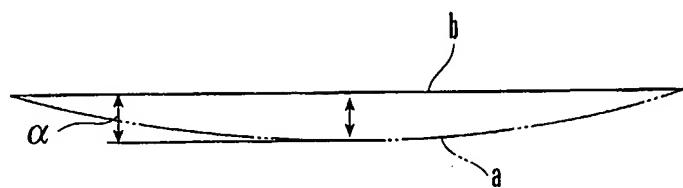


FIG. 11